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ABSTRACT

This study, conducted by the Basic Research and Implementation in DevelopinG Education Systems (BRIDGES) Project, demonstrates a relatively inexpensive way for governments to increase the effectiveness of their teaching force. The report describes distance teacher education programs in Sri Lanka and Indonesia as being cost-effective (the low institutional costs result from economies of scale and high cost recovery), especially those which combine self-instruction with tutor-supported small group learning, and are particularly effective in subjects that are verbal and information-oriented, as opposed to math- and skills-oriented. Following a foreword and an executive summary, the report is organized into five sections. The first section, an introduction, discusses the need for inservice teacher education, the promise of distance education, and the need for studies of program cost-effectiveness. Section 2 describes teacher education in Sri Lanka and Indonesia. The third section presents the current study: its objectives, an explanation of the concepts of training costs and program effectiveness, the overall research design, cost-effectiveness, and studies and findings in Sri Lanka and Indonesia. Section 4 presents cross-national comparisons. The final section suggests general implications for policy and specific policy implications for Sri Lanka and Indonesia. (LL)

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The Cost-Effectiveness of Distance Education for Teacher Training

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The BRIDGES Group includes educators, researchers, planners and policymakers committed to improving opportunity and quality in Thirld World schools. The goal of their collaborative effort is to identify policy options that will increase children's access to schooling, reduce the frequency of early school leaving and repetition, improve the amount and quality of what is learned, and optimize the use of fiscal and educational resources.

The *BRIDGES Research Report Series* is edited by the Harvard Institute for International Development. The *Series* is a collection of reviews of the state-of-the-art in research, and original research reports on basic education in developing countries. Each review summarizes research about a particular policy issue and suggests policy options. Original reports on BRIDGES-sponsored research present new information about the impact and costs of specific alternatives that the reviews have identified as most promising.

The views expressed in this document are those of the author and do not necessarily reflect those of the United States Agency for International Development.

The Cost-Effectiveness of Distance Education for Teacher Training

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Foreword

Teacher training is essential for improving the quality of education, especially in countries that have chosen to employ under- and unqualified teachers to achieve universal primary enrollment. One result of this choice has been a decline in the overall quality of education, and a larger-than-ever recurrent budget.

In-service training to improve the quality of the teaching force can be expensive, and out of reach for many education systems that are already underfinanced. Are there effective ways to train teachers that cost less than conventional methods? Can improvements in quality be made despite financial restrictions?

This paper focuses on an alternative, cheaper method for in-service teacher training. The Research Report to follow compares various methods for preservice and in-service training.[1] Both papers identify alternative methods that are as effective as conventional teacher training in terms of how much teacher trainees learn, yet cost less.

The results of the study reported here are promising. First, in some subjects it is possible to provide training that is at least as good as or better than that provided by conventional in-service programs, and at much less cost. This can be accomplished through the use of *distance education* methods. These methods are not equally effective for all subjects or in all contexts; this is not a general *panacea* for the problems of education in poor countries.

But there is a second part to the good news. The critical factor in distance education is not the capital-expensive hardware of radio and television transmitters and receivers. Successful programs can be run using correspondence methods, and broadcasts over unused commercial television channels or radio stations. It is not the technology of transmission that makes these programs effective, but the kind of learning situation that they create.

In distance education, learning materials are developed using principles of instructional design[2], which focus on how people learn, rather than on the subject matter being taught. The most effective distance education methods rely on cooperative or collaborative learning, in which groups of teacher trainees meet to discuss their lessons and the difficulties they are having with them. These meetings help sustain the motivation to study, and partially substitute for the presence of a teacher. The network of relationships established during the training program continues after it is finished and helps maintain the teachers' morale and motivation when they are back in their classrooms.

It is not the technology of transmission that makes (distance) programs effective, but the kind of learning situation that they create.

This study demonstrates one of the fundamental lessons of the BRIDGES Project. The principles of good education are universal and well-known. Students learn what we hope they will learn when we teach them in ways that enable them to learn. But while these principles are universal, they can be applied in many different ways. As a consequence, the practice of education is diverse. Which application is most appropriate depends on local circumstances.

Noel F. McGinn
April 19, 1991

Notes

1. Tatto, Nielsen, and Cummings, "Comparing the Effects and Costs of Different Approaches for Educating Primary School Teachers," forthcoming.
2. See Thiagarajan and Pasigna, "Literature Review on the Soft Technologies of Learning," Research Report Series #2. Harvard University, Project BRIDGES, 1988.

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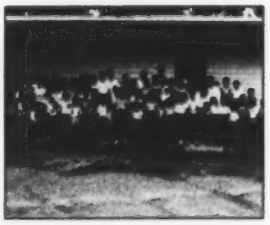

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Executive Summary

Most developing countries have expanded access to primary education so fast that they have been forced to field unqualified or underqualified teachers. Aware that this has had an adverse effect on the quality of their schools, they have subsequently taken steps to "upgrade" the credentials of these teachers through in-service training. Such efforts have often been hampered by insufficient budgets, low teacher incentives, and low quality training programs.

During the past two decades, ministries of education have begun to use distance education to overcome these obstacles. Distance teacher education programs have been launched in more than 40 developing countries to provide quality-controlled training to teachers at their own work sites at prices that governments can afford. Typically, such programs involve some form of self-instruction, supplemented by radio or TV programs and face-to-face tutorial sessions.

Distance teacher education programs in Sri Lanka and Indonesia are cost-effective, especially those which combine self-instruction with tutor-supported small group learning...

Since such programs do not require lecture halls, dormitories, or even instructors, they have lower recurrent costs than conventional programs. And since they lead to the required certifications, they fulfill a government's mandate to upgrade its teaching force.

Lower recurrent costs, however, are not a sure sign that programs are economical, since a full cost assessment requires attention to capital and development costs as well as the costs (direct and indirect) borne by students. Moreover, obtaining a distance education certificate does not necessarily make a teacher more competent. In fact, there has been very little research on how economical distance programs are (once all of the costs are considered), and whether or not they increase teacher competence.

The current research is an attempt to fill this gap in the literature. It features distance education (DE) programs in two Asian countries—Sri Lanka and Indonesia. In both countries conventional and distance teacher education programs have been set up in order to provide the same level of training. Our aim was to measure the total costs of the two programs and to assess their effectiveness in terms of gains in teachers' mastery of subject matter, improved teaching skills, and more fully developed professional attitudes. In Sri Lanka we examined three programs all geared towards initial credentialing of primary school teachers: a residential pre-service program at the Colleges of Education, a campus-based in-service program at the Teachers' Colleges, and the Distance Education program, sponsored by the Ministry of Education. In Indonesia we examined two programs that provide Diploma II (two years post-secondary) training to lower secondary school teachers; one at the conventional Institutes or Faculties of Education, and one delivered through distance education by the Open University.

Our perspective was comparative both within and between countries. Within countries, we wanted to compare DE program costs and effects with those of more conventional in-service training programs (possible in Sri Lanka, not in Indonesia), and with those of pre-service programs geared towards comparable levels of training and certification (possible in both countries). The first kind of comparison would be useful in determining whether distance education can take on in-service training roles that are traditionally assigned to teachers' colleges; the second could determine whether teacher competence and professionalism can be acquired as cost-effectively on-the-job as they can through pre-service professional training programs. Comparisons between countries were made to determine whether the results found in one national context were also found in

the other, and to explore whether national-level program design features influenced the relative cost-effectiveness of the distance education programs.

Results Concerning Program Costs

The following main points can be made about the costs of the distance education programs in the two countries:

1. The distance teacher education programs in both Sri Lanka and Indonesia are significantly cheaper than their conventional counterparts. Total annual costs per capita are 1/6 to 3/5 of campus-based programs.
2. The proportion of total costs borne by the trainees is considerably higher in distance education programs than in the conventional programs. In Sri Lanka the actual amount spent or foregone by trainees is still lower for the DE program than for conventional programs; in Indonesia it is higher.
3. From the government's point of view, higher student costs represent a form of cost recovery. The relatively high level of cost recovery in DE programs in both Sri Lanka and Indonesia means that "cost to sponsor" (the government) is much lower than overall costs: In Sri Lanka government costs for DE are about 1/10 and 1/8 those for Colleges of Education and Teachers' Colleges, respectively, whereas in Indonesia the costs to government for DE are about 1/4 of the conventional pre-service program costs.
4. Economies of scale have kept the unit costs down in both countries, given the fact that about 5000 students are currently enrolled; however, given the relatively high fixed costs in Indonesia, that country is in a position to economize more through increased enrollments than Sri Lanka is.
5. The mix between capital and recurrent costs in the distance education programs in the two countries is dissimilar, being highly dependent upon the trade-off between the use of tutors and mass media and the construction of unique campus facilities.
6. Contrary to popular notions about distance education, opportunity costs are a significant cost factor for those who study during their "spare time." Individual study time is often in direct competition with time spent earning extra income. Overlooking opportunity costs for distance education students will result in a serious underestimation of their private costs.

Results Concerning Program Effectiveness

The following main points can be made about the effectiveness of distance education programs in the two countries:

1. In Sri Lanka the Distance Education in-service teacher training program is effective in improving the knowledge, skills, and attitudes of its trainees:
   - It is more effective in improving knowledge and skills in language than in mathematics.
   - It is more effective than the Teachers' Colleges (also in-service training) on four out of five indicators of effectiveness (on the fifth, language skills, it is essentially the same).
   - It is more effective than the Colleges of Education (pre-service) in improving language knowledge and professional attitudes. It is somewhat less effective than the CE in improving math knowledge and language skills, and considerably less effective in improving math skills.
2. In Indonesia the distance education in-service teacher training program is relatively effective in improving the knowledge and skills of language teachers but ineffective in improving those of mathematics teachers. In addition, DE trainees in both courses appear less positive in their professional attitudes at the end of their training than they did at the beginning, whereas trainees in the conventional colleges appear to experience virtually no change.
3. These findings appear related to various structural/organizational aspects of the programs, most particularly: different emphases in the curriculum, the mix of self-instruction and group activities, and the trainees' opportunity to relate their learning directly to what takes place in the classroom. The most effective form of distance education for teacher training appears to be that which is "not too distant", combining self-instruction with school-based group interaction.

Results of Cost-Effectiveness Assessments

The cost-effectiveness ratios that were developed in the study are presented as indicators of program value per money or efficiency. Our main findings were:

1. In Sri Lanka the Distance Education program was clearly more cost-effective than the conventional pre- and in-service training programs.
2. In Indonesia the DE language program was more cost-effective than its conventional (pre-service)

equivalent, but the mathematics program was less so.

3. The least efficient program in Sri Lanka was the conventional campus-based in-service training program.
4. The least efficient program in Indonesia was the DE program in mathematics.
5. In both countries, if the cost-effectiveness ratios are computed using only government costs, distance education programs appear even more efficient compared to conventional programs.

Summary

The findings of this study indicate that there is a relatively inexpensive way for governments to increase the effectiveness of their teaching force. Distance teacher education programs, at least those in Sri Lanka and Indonesia, are cost-effective, especially those which combine self-instruction with tutor-supported small group learning; and particularly in subjects that are verbal and information-oriented, as opposed to math and skills-oriented. Since the low institutional costs of distance education programs result from economies of scale and high cost-recovery, it is important that the programs keep their enrollments up and their student cost-burden relatively high. Nevertheless, policymakers should make sure that total student costs (direct and indirect) do not become too high, since this will suppress demand and undermine the economies of scale that low-cost programs depend on.

Section I: Introduction

The Need for In-Service Teacher Education

During the two decades between 1960 and 1980 developing countries made substantial progress in increasing access to basic education. In this twenty year span the world enrollment at all levels of formal education nearly doubled, and most of this increase occurred in developing countries. The proportion of primary school-age children enrolled in school was on the average 20 to 30 percent higher in the 1980s than in the 1960s. Some countries, such as China, Jamaica, Tunisia, Sri Lanka, and Indonesia, nearly reached universal access to primary education in the 1980s. Increases in secondary education enrollment were even higher, reaching 280% on the average (Hallak, 1990: 9-10).

As impressive as these accomplishments are, it is now apparent that in almost every case quantitative expansion came at the expense of quality. Schools were built and pupils enrolled, but the books and equipment they were provided with were inadequate and the teachers too few and undertrained. To solve the problem of teacher shortages, governments have increased pupil-teacher ratios (in eight countries in Africa the ratio is over 50 students per teacher at the primary level) and pressed into service those who are unqualified to teach. According to one recent analysis, as many as half of the teachers in the developing world are unqualified according to the countries' own formal standards (Andrews, Housego, and Thomas, 1990: 63). This problem is particularly severe in regions where access has expanded especially rapidly. For example, in 10 out of 33 sub-Saharan African countries, the majority of primary teachers have not even completed secondary education (Hallak, 1990: 37). Within countries, the problem of underqualified teachers is worse in rural or remote areas, which means that educational quality in these areas is far inferior to that available in the cities (ICDE, 1974).

Recent reviews focusing on Third World countries have documented the relationship between teacher qualifications and teaching performance (Guthrie, 1985) as well as student achievement (Fuller, 1987). Student achievement has been shown to relate, not so much to the *amount* of teacher training, as to the *kind* of training. The most effective teacher training focuses on subject-matter knowledge beyond that expected of students, and subject-specific pedagogical or teaching skills (Dove, 1986; Lockheed and Verspoor, 1990).

Although this kind of training is available in the Third World, it is obvious from the above that it has failed to supply teachers in the numbers needed. Attempts to increase output in the conventional colleges has often been counterproductive, since it has often been accomplished by lowering entrance standards and shortening the study time for teacher certification (Coldevin and Naidu, 1989). In addition, conventional forms of teacher education, generally designed as pre-service programs, are not equipped to upgrade the undertrained teachers who are already in the teaching force. For this, in-service training is the "obvious remedy" (Andrews, Housego, and Thomas, 1990). According to these authors, "The pace of development of such programs is, in fact, increasing as many countries turn their attention and resources to the challenge of increasing the quality of education" (p. 64).

To solve the problem of teacher shortages, governments have increased pupil-teacher ratios...and pressed into service those who are unqualified to teach.

A major drawback to this remedy is the fact that in-service training is relatively time consuming and expensive, especially when it requires attending courses at teacher training colleges (Ansari, et al., 1987). With government budgets for education stagnating or even shrinking throughout the developing

world in the 1980s, this factor has put campus-based in- service training out of reach for teachers in many of the poorer countries. In addition, it is not at all clear that in-service training has given teachers the knowledge and skills they need for improving their own and their students' performance. In many countries, conventional approaches to teacher upgrading are out of touch with recent changes in curriculum, far removed from the realities of classroom life, and overly theoretical in orientation (Dove, 1986; Ansari, et al., 1987). Reviewers Avalos and Haddad (1981) note a lack of evidence about the effect of in-service training upon students and the effectiveness of various ways of organizing in-service training. What developing countries urgently need are in-service teacher training systems of documented effectiveness and affordable cost.

The Promise of Distance Education

Increasingly, developing country governments have turned to distance education to achieve this elusive combination of effectiveness and economy. Distance teacher education programs (DE) allow teachers to study at a time and place of their choice using self-instructional or correspondence materials, supplemented by a mix of audio or video cassettes, radio/TV broadcasts, and face-to-face tutorials.

By the mid-1980s distance teacher education programs had been established in more than 40 developing countries. Almost half of them (18) were African; the rest were Latin American (11), Asian (8), Middle Eastern (2), and regional (West Indies and South Pacific). Some of the programs are extensions of conventional universities, such as the one mounted by the Institute of Adult Studies of the University of Nairobi (Kinyanjui, 1974; Coldevin and Naidu, 1989); some are mounted by "open universities" such as the Allama Iqbal Open University of Pakistan (Abbas, 1987) or the Indonesian Open Learning University (Setijadi, 1987); and some are run by special government centers or agencies such as the Centro de Educacao Tecnica of Brazil (Oliveira and Orivel, forthcoming) or the Distance Education Program of the National Institute of Education of Sri Lanka (Dock, Duncan, and Kotalawala, 1988).

Distance education programs have been set up for different purposes and with different structures. Some programs are geared towards teachers who have their academic qualifications but lack teaching credentials. Such programs tend to place a heavy emphasis on teaching skills or pedagogy. Other programs are for experienced teachers who were inducted into the teaching force without the required academic attainment. These teachers need academic enrichment or certification but little training in pedagogy. A final set of courses is for teachers who need a balance of subject matter mastery and pedagogy.

Brophy and Dudley (1982) have named the dimension related to purpose **"subject coverage"** and that related to course structure **"media mix."** They have classified distance education courses along these two dimensions, using the following categories: **subject coverage** (academic alone, pedagogy alone, limited academic with pedagogy, and complete academic with pedagogy); and **media mix** (correspondence alone, correspondence and media, correspondence and face-to-face, and correspondence, face-to-face, and media). Fully 50% of all projects they reviewed (50) were "complete academic with pedagogy" and 50% used "correspondence, face-to-face and media." About 30% were an intersection of the two.

Distance teacher education appears to offer numerous advantages not found in conventional programs. They have been summarized by Coldevin and Naidu (1989) as follows:

> From the practicing teachers' viewpoint, studying *in situ* means that they can attain professional certification or academic upgrading without interrupting their earnings, a significant point in developing countries where many teachers also have small farms.
>
> Large numbers can be served at any one time with no discrimination against those who live in remote areas.
>
> It obviates the problem of replacing the teachers on college-based courses with substitutes who—when they can be found at all—often have even poorer qualifications.
>
> It reduces the tendency towards urban drift resulting from trainees from rural areas not wanting to return to their original posts. The teacher's work situation can serve as a basic resource for his/her studies—with learning applied immediately in the classroom; sharing learning experiences with village-based colleagues can provide a multiplier effect; and DE print materials are frequently valuable references in locations where access to libraries is limited (p. 12).

The Need for Studies of Program Cost-Effectiveness

Such advantages, although compelling, still do not provide evidence that DE programs are more effective and economical than other forms of in-service training, or, in the words of one reviewer, that they provide "value for money" (Vivian, 1977). In fact, the small but growing research literature in this field is almost silent on this issue. In a recent review of 40 such projects, it was possible to find only 14 studies (16 if the studies reported here are counted) that have hard data on relative (i.e., DE vs. conventional programs') effectiveness and costs. Seven of those studies allowed for cost-effectiveness analysis. Of those, five found DE to be more cost-effective than conventional programs and two found it to be less so (Nielsen, 1990).

Not only are studies of program costs and effects few in number, but they are also beset by methodological problems which have limited their credibility and generalizability. For example, one can discern a pattern of findings in the available cost analyses (Hawkridge, et al., 1982; Mahlck and Temu, 1989; Oliveira and Orivel, forthcoming; Taylor, 1983); namely, that DE programs are less expensive than conventional alternatives as long as their enrollments are high enough to permit economies of scale. However, the studies conducted so far have generally relied on secondary cost data and overlooked private costs, including trainees' opportunity costs. Thus, they can still be considered inconclusive.

Findings about program effectiveness have been limited by the narrow concept of effectiveness used (course pass rates or examination scores), by the failure to control for trainee background characteristics (age, teaching experience, learning ability, and sex), and by weak research designs which fail to account for threats to validity, such as selectivity due to course dropout.

Mahlck and Temu (1989), who compared the effectiveness of Tanzanian teachers trained by distance and conventional means, used a broader concept of effectiveness than most researchers (subject matter mastery and observed teacher behaviors) and controlled for background factors. Even though their results are weakened by the fact that data was collected three years after course completion, allowing many "historical" events to intervene, their findings are germane to this study. They find, for example, that: a) there was no significant difference in subject matter mastery between DE trained teachers and those trained conventionally except in the case of science, where DE trainees scored significantly lower; b) in teaching skills, DE trained teachers were equivalent to campus trainees, except in evaluation skills (where they were better) and group organizing skills (where they were worse). Equivocal results here are not surprising. Because those trained at a distance are already in classrooms, they presumably have an advantage over those who have not had classroom experience yet (although the experience might be negative, setting bad habits). On the other hand, campus trainees are in a better position to learn effective skills by watching good teachers and doing practice teaching exercises that are not generally available to those trained at a distance. One might hypothesize that distance education participants would be more skillful in an absolute sense than those trained in pre-service training programs, but also that their skill levels would not be raised as much by the training program.

The above brief review suggests that to make research more useful to policymakers and planners, it is critical to have more evaluations of program costs and effects that:

a) measure costs directly, both those incurred by the institutions and by the trainees;

b) take into consideration trainee opportunity costs;

c) measure teacher competence in terms of subject matter mastery, professional skills and attitudes, and student achievement;

d) control for trainee background, entry-level knowledge and skills, and selection effects;

e) compare DE programs to other forms of teacher education.

Such research would be even more valuable if it could be longitudinal and comparative: longitudinal in order to identify program effects clearly; comparative in order: a) to replicate salient findings, thus strengthening the case for their use, even in countries which did not participate in the research; and b) to show the influence of design factors.

Section II: Teacher Education in Sri Lanka and Indonesia

This paper reports on new efforts to assess the costs and effectiveness of distance teacher education in two developing countries in Asia: Indonesia and Sri Lanka. These efforts were meant to provide policymakers with fresh insights from research designed to overcome many of the weaknesses of the past. Before this research is described we will focus briefly on the historical and educational context of the distance education programs in the two countries involved.

Sri Lanka

Sri Lanka has distinguished itself as the only major country in the South Asian region (which includes Bangladesh, India, Nepal, Pakistan, and Sri Lanka) to achieve a high rate of literacy and enrollment in basic education. In the mid-1980s about 85 percent of the school-age population was enrolled in basic education, and the literacy rate was close to 80 percent. This achievement should be seen in light of the fact that Sri Lanka is also one of the poorest countries in the world (GNP per capita 339 US dollars as of 1984).

...study circles and practical sessions... (give) teachers the opportunity to practice skills and reflect on what they are learning...

This impressive accomplishment is rooted in the government's commitment to universal primary education, a commitment which was made shortly after gaining independence from the British in 1948. This strong national commitment to education is also supported by the religion of its early national leaders, Buddhism, which stresses the importance of cultivating the mind. The growth of access to education since independence, however, has not been accompanied by a growth in educational quality. Only a small minority of Sri Lanka's 10,000 schools—mostly the elite, private ones—are considered to provide high quality education.

The extreme centralization of educational management and the educational paradigms inherited from the colonial period produced an "overloaded" basic education system which was out of step with the rapid social and economic changes of the post-independence era. In addition, the system has been beset by problems of repetition, dropout, and low student achievement, indicators of low quality that became the chief concern of Sri Lankan educational reformers as they entered the 1980s.

The government set up an educational reform committee which produced a White Paper in 1981 that called for measures to improve the quality of education on the island. Among them was a provision for the reform of teacher education. Problems in this area were clear: as recently as 1967 fewer than one half (42%) of the teachers had been trained. By 1979 that figure had improved to 61%, but this still left 37,000 teachers who had received no institutional training. Moreover, there were problems of teacher absenteeism and desertion from the teaching profession.

Proposals for reforming teacher education included raising the qualifications for those entering teacher education, making changes in the teacher education curriculum to correspond to changes in the elementary school curriculum, and introducing approaches to teacher training based on current research. Up to the early 1980s most teacher training for basic education was in-service training of non-graduate teachers during a two year residence at one of the country's 16 Teacher's Colleges. These Colleges were inadequate in numerical terms, if for no other reason, since they could only accept a total of around 2000 candidates per year.

The reforms initiated under the White Paper gave birth to two new approaches to primary school teacher training: *pre-service* training at the newly

constituted Colleges of Education, starting in 1985; and in-service training through *distance education*, which was initiated in 1983 by the National Institute of Education with help from SIDA, the Swedish International Development Agency. The Colleges of Education were given the task of training well-qualified high school graduates to become teachers. The Distance Education program was directed at assisting the Teachers' Colleges in clearing the backlog of untrained teachers currently working in schools around the country.

A closer examination of these three kinds of teacher training institutions reveals their similarities and differences. The traditional teacher training institutions, the Teachers' Colleges, have been in existence since before independence. Their purpose is to improve the skills and pedagogical knowledge of experienced teachers. Candidates are expected to have either O- or A-level passes and a good teaching record. They are given residential training without charge (except for a modest "facilities" fee) for two years, during which time they continue to draw their teacher salaries. The program emphasizes principles of primary education (42% of the course content), professional foundations courses (23%), and subject matter (16%). Only 10% of the content is devoted to teaching practice. Instruction is through lectures, discussions, demonstrations, projects, microteaching, and field trips. Originally there was a third year, a supervised internship at the trainee's own school, but this was discontinued in 1988. At graduation, the trainees receive a trained teacher's certificate, have good opportunities for advancement, and receive a salary increase.

The relatively recent Colleges of Education, seven in number as of 1988 and producing about 1500 graduates a year, see their main task as molding a complete and effective teacher with the knowledge, skills, and attitudes that will be required of future leaders in education. The Colleges select highly motivated high school graduates (A-level) and place them in a full-time residential program for two years, where they have a heavy load of course work and extracurricular activities, all of which are undertaken as a "cohort." Courses in professional foundations, principles of primary education, and subject matter are about equally weighted. Course work on teaching practice takes up only about 11% of the curriculum, but an internship in the third year, which consists mainly of supervised practice under faculty members, is taken seriously. Trainees receive a monthly allowance (much of which is recovered in the form of facilities fees). In exchange, once they graduate and are awarded their teaching credential, they are expected to teach for at least three years in difficult schools in poor or remote areas.

The Distance Education program was designed to allow teachers to earn their teaching certificate at their own pace while working. The program admits experienced teachers with varying educational backgrounds (O-level or A-level). Those in the program may take from three to five years to finish. In contrast to distance education programs in other countries, it is not a correspondence program. Instead, trainees make frequent trips to regional centers (there are 30 on the island) where they pick up self-instructional materials and submit assignments to tutors, who evaluate their progress. During some visits to the centers, study circles and practical sessions are arranged, giving teachers the opportunity to practice teaching skills and reflect on what they are learning in relation to their everyday classroom experiences. During school vacations five-day "contact sessions" are held (eight per course) which focus on a wide range of teacher competencies, and are based on feedback from the centers. Finally, group tutors from the regional centers periodically visit the teachers in their schools to determine the difficulties teachers are having in applying their new knowledge and skills.

From 1983 to 1988 about 5000 primary school teachers graduated from the Distance Education program. About 1/3 of them had been officially designated as part of the untrained backlog (Dock, Duncan, and Kotalawala, 1988). It has been difficult to reduce the backlog quickly, however, since new untrained teachers are still appointed at the rate of at least 4000 per year. According to the above authors:

> The implications of these figures for the future orientation of the distance education teacher training program are quite clear: the need for the distance training for non-graduate teachers will continue for a considerable time. In addition to the backlog of untrained non-graduates from previous years, the current large-scale recruitment of untrained non-graduates adds substantially to the pool from which the distance programme draws its students" (Dock, Duncan, and Kotalawala, p. 66).

Policy Issues

In the mid-1980s education authorities in Sri Lanka decided to evaluate the effectiveness of the educational reforms initiated earlier in the decade. Implementing the reforms had required vast resources; the continuation of new alternatives depended on their cost-effectiveness in improving the quality of education on the island. In addition, there was a concern about the lack of coherence in the national approach to teacher education, since the various programs had been managed and evaluated separately. Furthermore, there was a need to understand whether the different approaches, all based on foreign models, were suitable in the Sri Lankan environment. Educational decision makers thought that research would help them develop coherent policies and a truly national system of teacher education.

The demand for such research coincided with research funding from USAID under the BRIDGES Project. BRIDGES in Sri Lanka was developed as a series of collaborative research projects between the National Institute of Education and a team of US-based researchers organized by the Harvard University Institute for International Development. One of these projects was a study of the effectiveness and costs of teacher education in Sri Lanka. (See Tatto, Nielsen, and Cummings, 1991.)

Indonesia

During the past two decades Indonesia has been extraordinarily successful in increasing access to basic education, in large part because of its oil boom in the mid-1970s. Whereas a realistic target for primary school enrollment in the early seventies was 55 percent, by the late eighties (1988/89) the country had attained near universal primary education (95-98% coverage). At the beginning of that expansion qualified teachers were scarce and the nation's capacity to produce them limited. By the late 1980s there was a general surplus both of qualified primary school teachers and of the capacity to produce them (except in rapidly growing and remote areas of the country). In the current Five Year Plan (1989-94) improving the quality of teachers is thus given more emphasis than increasing the number of teachers.

Having attained universal primary education, the Indonesian government has recently decreed that the basic cycle of education will include lower secondary education. This has created new pressures for expansion on a subsector that has already expanded rapidly. In 1986 lower secondary schools (SMPs) were enrolling about 45% of primary school graduates. During the current Five Year Plan this figure is expected to climb to 65%. Because of the rapid expansion going on at this level, teacher shortages have been acute, especially in mathematics, science, and language (Indonesian and English). For example, during the mid-1980s the teacher training colleges were graduating around 13,000 secondary school teachers a year, but the projected demand in 1986/87 was almost four times this number (IEES, 1987). In addition, a majority of the practicing teachers are underqualified. The current minimum qualification for SMP teachers is the Diploma II (D-II), consisting of two years of post-secondary school training. As of 1987/88 the proportion of active SMP teachers (public and private) who had the D-II qualifications or above was only about 40% (Office of Educational and Cultural Research and Development, 1989). This meant that about 237,000 SMP teachers had qualifications below the D-II level.

In 1985 the newly established Open University of Indonesia (UT)[2] began to provide upgrading at the D-II level to practicing SMP teachers through *distance education*. This upgrading was not mandatory, but during its first few years fees were waived to encourage teachers to become involved. Enrollment has been open to everyone who has their D-I diploma and has taught for at least two years. Learning has been basically through self-instruction. Tutorials are voluntary and are provided, two per semester, at one of 32 regional centers around the country to groups of students on request. In addition to the official tutorials, some trainees have organized their own study groups, but since this is unofficial the exact incidence of this is unknown. Audio and video cassettes are provided as additional resources in a number of courses, and TV and radio programs cover some of the basic university courses.

The Diploma provided by UT requires a total of 40 credit hours, equivalent to one year of full-time study, with 80% of the credits directly related to one's subject matter specialty (math, national language, English, biology, chemistry, etc.). The other 20% are distributed across general theory and methods courses. There is no practice teaching in the program since the teacher's own experience is assumed to have provided sufficient training in practical skills. Trainees study part-time while they continue to work as teachers; they generally take between two and four years to complete the program.

Because of cuts in Ministry of Education funds (related to oil price declines) the government has had to suspend financial support to students in the program for the past two to three years. Thus, most students in the past two cohorts have had to pay full tuition and fees, a condition that has negatively influenced new enrollments over the past two years. During 1989 a new Civil Service Law gave those who had the D-II diploma the possibility of an accelerated promotion. With this new incentive it is expected that enrollments will increase again.

A D-II program is also available at conventional teacher training institutes or faculties of education at universities. As a pre-service program it is open to high school graduates and operates in the conventional campus/lecture mode. The program takes two years to complete and carries 80 credit hours, 69% of which are in subject specific courses, 19% in teaching methods (including 3 units of practice teaching) and the rest in general theory. This course is highly subsidized, but the students do pay modest fees and pay for their own books, materials, and accommodations.

Policy Issues

The Indonesian government is simultaneously creating new cohorts of teachers trained at the D-II level and upgrading current teachers to that level. The first program is highly subsidized and expects trainees to gain skills before becoming teachers; the second requires teachers to pay for a high proportion of the costs and assumes that actual on-the-job experience will provide the necessary teaching skills. These two programs could be considered alternative paths to the same end; their relative importance in terms of government funding could be determined on the basis of their relative cost-effectiveness. This is in line with recent recommendations from a joint *Education Sector Review* conducted by the Ministry of Education and the US Agency for International Development (1987). Its section on teacher education concludes with the following:

> The policy options presented within the teacher education subsector revolve around two themes: (a) improving the quality of teacher training at all levels, and (b) increasing the number of trained teachers at the secondary and tertiary levels. Each of these options should be judged on the basis of information as to their cost effectiveness. This is impossible without continuously available evaluative information on program implementation costs and overall program impacts. An underlying principle, therefore, in each of the policy options considered is the inclusion of a strong evaluative component, both formative and summative.

When the BRIDGES research program was developed in Indonesia, Ministry officials made it their highest priority to assess the costs, effectiveness, and benefits of current efforts to train teachers through distance education. The Indonesian Open Learning University took the lead role in a consortium of Indonesian institutions and the Institute for International Research, Inc., of Arlington, Virginia headed the US-based effort. (Detailed results of this collaboration are found in Nielsen and Djalil, 1989 and Nielsen, Djalil, et al., 1990).

Section III: The Current Study

Objectives

We organized the current paper in order to demonstrate, compare, and contrast the cost-effectiveness of distance education programs for training teachers in Indonesia and Sri Lanka. Since distance education has been presented as a low-cost alternative to conventional campus-based training, we sought hard evidence of this in the two countries. We also wanted to determine how effective this innovative approach had been in improving teachers' subject knowledge, teaching skills, and professional attitudes. Initially, we also planned to assess the relationship between the teachers' training experiences and student learning gains. However, since this was ultimately only possible in Sri Lanka, it is not included in the current study.

Our perspective was comparative both within and between countries. Within countries, we wanted to compare DE program costs and effects with those of more conventional in-service training programs (possible in Sri Lanka, not in Indonesia), and with those of pre-service programs geared towards comparable levels of training and certification (possible in both countries). The first kind of comparison would be useful in determining whether distance education can take on in-service training roles that are traditionally assigned to teachers' colleges; the second to determine whether teacher competence and professionalism can be acquired as cost-effectively **on-the-job** as they can through pre-service professional training programs. Comparisons between countries were made to determine whether the results found in one national context were also found in the other, and to explore whether national-level program design features influenced the relative cost-effectiveness of the distance education programs.

...we considered program effectiveness in terms of teachers' subject knowledge, teaching skills, and professional attitudes.

Explication of Concepts: Training Costs and Program Effectiveness

In order to make the two studies comparable, the research teams in the two countries tried to explicate the main research concepts in similar ways. This does not mean that the variables and their measurement were precisely the same: differences in educational systems, staff training, and research conditions all meant that rather different approaches were taken to variable construction and data collection. This was of little concern to us as long as the basic concepts were the same, since our intention was to compare patterns of findings and relative costs/effects, and not actual test scores. We considered the study's two main concerns to be **training costs** and **program effectiveness**.

Training Costs

Our intent was to capture the **real costs** of training in the two countries, using the taxonomy suggested by Tilak (1985)[3], which begins by distinguishing between **institutional and private costs**. For **institutional costs**, we included both **recurrent costs** (staff salaries and benefits, training materials, utilities, maintenance of facilities, student health and recreational services, staff training) and **capital costs** (annual costs for buildings, equipment, and vehicles). We counted costs borne both by the training institutions themselves and by other institutions, such as radio stations or donor agencies.

Private costs included both **direct costs** (tuition and other fees, room and board, books and supplies, and transportation) and **indirect costs** (earnings foregone as a result of taking the course). **Foregone earnings** were of two kinds: for those who were already in the teaching force, they were estima-

tions of the earnings actually sacrificed each month; for those who had not entered the workforce yet (but would have gone to work if they had not entered teacher training), they were estimations of the amount the trainees could be earning.

For analytical purposes, we combined the two kinds of costs into a measure of total costs per academic year and per course and then figured unit costs by dividing by the number of participants in the courses. For the distance education programs we transformed the cost of part-time study into that for a full-time equivalent. Thus the unit cost figures that we used were total cost per trainee per year (or equivalent) and total cost per trainee per cycle (the entire course).

Program Effectiveness

As mentioned above, we considered program effectiveness in terms of teachers' subject knowledge, teaching skills, and professional attitudes. These three dimensions of effectiveness are further explicated as follows:

Subject knowledge. Since every primary school curriculum emphasizes language and mathematics skills, we decided to test the teachers on their knowledge in these two subjects. There was a difference between the two countries in choice of languages. In Indonesia we chose the national language (Bahasa Indonesia), a "mother tongue" for very few; in Sri Lanka we chose one of the country's two principal mother tongues, Sinhala or Tamil. In both countries mastery was defined as knowing what the pupils were expected to know in the two subject areas, and acquiring subject-specific background knowledge from the teacher training programs. Thus, test items were at two levels, those drawn from the school curriculum and those drawn from the training college curriculum.

Teaching skills. The two countries defined effective teaching practice in their own ways, based upon official statements (Indonesia) or expert opinion (Sri Lanka). However, in both countries teaching skills were considered to have both a theoretical and a practical aspect. In Sri Lanka this meant understanding how children learn specific subjects (theoretical) and the subject-specific pedagogical skills related to this understanding (practical). In Indonesia it meant knowing the appropriate teacher behaviors in particular learning-teaching situations (theoretical), and being able to put them into practice in a classroom setting (practical). How these concepts operated in the two countries will be covered in more detail in the separate "data collection" sections under each.

Professional attitudes. One of the main objectives of teacher education in both countries is shaping professional attitudes and commitments. The domains considered important were attitudes about teaching in general, about the teaching profession, about students, and about the community. In Indonesia, where we were dealing with subject matter specialists, there was an additional section on attitudes towards the field of study. Measurement was through the use of validated attitude scales, in which the respondents were prompted to agree or disagree with statements of value or opinion.

The Overall Research Design

Comparison Groups

Since the main objective of this research was to compare the cost-effectiveness of distance education with that of more conventional approaches, we paid careful attention to selecting appropriate comparison groups in both countries. In Sri Lanka, the pre-service College of Education and the in-service Teachers' College were both comparable to the Distance Education program in level and objectives, and were thus chosen as comparison groups. In Indonesia, the same Diploma II course is offered both on conventional campuses (pre-service) and through distance education (in-service). The two programs are essentially equivalent in terms of their offerings, except that the pre-service course puts more emphasis on pedagogy, based on the assumption that practicing teachers have already acquired basic teaching skills. There are also differences in the length of the two programs. The campus-based program lasts two full years; the distance education lasts the equivalent of one full year (given the fact that trainees have been through a previous in-service program). This did not hamper our efforts to compare costs, since we first computed cost per credit hour, and then converted this into cost per year and cost per cycle. For comparison's sake, the distance education costs were presented in terms of a "full-time equivalent." With respect to the effectiveness assessment, it was necessary to keep in mind that distance education learners covered the equivalent of the second year of the D-II program. This will need to be taken into account in interpreting learning gains.

Comparison across countries was also on our agenda. This was not as straightforward. Distance teacher education in Sri Lanka was for both primary and secondary teachers, but policymakers there wanted the research to focus on the primary cycle. In Indonesia, distance education programs were available for lower secondary school teachers but not primary teachers. Since Indonesians have recently combined primary and lower secondary into a single basic education cycle, we can say that in both countries the focus is on basic education. However, in Indonesia the teachers in our study were trained as subject matter specialists, whereas in Sri Lanka they are trained as class teachers (expected to cover all subjects). Since what we decided to compare across countries were themselves comparisons (between DE and conventional programs) and not teachers' costs or effectiveness scores, we do not feel that this limitation poses any real threat to the validity of this undertaking. In interpreting the results we do keep in mind that mastery in math and language is part of a larger subject matter package for primary school teachers, whereas for secondary school teachers it is a single specialty. That does not prevent us from drawing conclusions about the relative effectiveness of distance education in preparing teachers of both countries in these subject matters.

Research Design

The most appropriate way to compare the alternative approaches on the effectiveness measures within each country would have been to follow trainees through an entire cycle, using a longitudinal design. This would have allowed for pre-test and post-test measures from the same trainees and the calculation of change scores. In our case, there was only one year for data collection, not enough time for a longitudinal study of programs lasting two to four years. We thus opted for a cross-sectional design. This meant drawing samples of teacher trainees both from among those who had just begun their programs (**entry-level trainees**) and from among those who had just completed it (**exit-level trainees**). Assuming that the two groups are essentially from the same population (we tested and adjusted for this), we treated the difference between the two groups on our measures as proxies for change scores.

With these general design features in mind, we will now describe the conduct and results of the research in the two countries. After that we will draw the findings from the two countries together to demonstrate and explain similarities and differences.

The Cost-Effectiveness Study in Sri Lanka

Sampling, Data Collection, and Data Analysis

We examined two institutions from each kind of program in Sri Lanka, one from the coastal area near Colombo, and one from the hilly regions in the central interior.[4] A quota sample of fifty students was to be drawn from the entry-level and exit-level students in each institution, yielding a sampling frame as follows:

Sampling Frame: Sri Lanka

		Level	
Type	Institution	Entry	Exit
Colleges of Education	A	50	50
	B	50	50
	Total	100	100
Teachers' College	A	50	50
	B	50	50
	Total	100	100
Distance Education	A	50	50
	B	50	50
	Total	100	100
	Total	300	300

The table below demonstrates the extent to which our target sample was achieved. Political instability at the time of data collection kept many trainees at home, thus most cells were somewhat below our quota of 100, and one cell, that for the Distance Education entry-level group, was seriously below. Just before data collection from this group, changes occurred in program management that delayed intake that year. By the time intake began, political instability was at its height. The 24 teachers who enrolled at our sample DE centers that year and came for testing represent a much smaller group than we had hoped for. Nevertheless, they were not significantly different from their exit-level comparison group in background characteristics. Thus, we decided to proceed with the analysis despite the small numbers. Self-selection may still have been a factor, since those who persevered in the face of difficulty were perhaps more highly motivated and thus prone to higher achievement than those who did not. Such a bias might inflate the test scores of their group, making the differences between their test scores and

those of the exit-level group *smaller* than they would otherwise be. Thus, any selectivity bias in the findings for this program would be in the direction of *understating* the differences that actually exist between the groups.

Achieved Sample: Sri Lanka

Type of Institution	Level	
	Entry	Exit
College of Education	100	86
Teachers' College	92	78
Distance Education	24	73

Data Collection

Institutional cost data was collected by interviewing college presidents and their financial clerks. In the case of Distance Education, interviews were conducted with administrators at the national center as well as senior tutors at the regional centers. Since the colleges did not keep inventories of their equipment, we elicited the cooperation of local administrators in making a physical inventory, and estimating the replacement value of each piece of equipment. Student costs were gathered from the exit-level trainees via questionnaire. They were asked to list their actual expenses and foregone income during the years of their training.

Effectiveness measures were all designed as paper-pencil tests. Trainees took two tests of subject matter mastery, one for mother tongue and one for mathematics. Each had multiple choice and open-ended items covering content from both the primary school and the teacher education curricula, as mentioned above. They also took two tests of teaching skills, related to learning and teaching the two subject matters. The tests presented situations as they occur in the classroom in the teaching of specific subject matter. Respondents were expected to use their pedagogical knowledge in describing how to deal with the situations. The dimensions measured included the teacher's arrangement of the instructional environment, the type of instruction provided (teacher versus student centered), attention to the curriculum, use of instructional materials, and level of interaction with the pupils. The observation of teacher classroom behavior was also a part of the research in Sri Lanka, but only during a later study (not reported on here) of the teachers once they had been teaching for a year after the completion of their programs. (See Tatto, Nielsen, and Cummings, 1991.)

Data Analysis

The unit costs figures were calculated for each institution and then pooled according to type (Colleges of Education, Teachers' Colleges, and Distance Education). Costs were broken down by type (capital vs. recurrent) as well as source of funds (institution vs. trainee). Care was taken to treat tuition and fees on the one hand, and student stipends or allowances on the other, as transfer payments so they wouldn't be double counted.

The effectiveness analysis involved a comparison of mean scores and standard deviations for entry- and exit-level groups, pooled across the two institutions of the same type. To account for possible differences in background and experience, controls were made for age, gender, educational level before entering the program, and previous teaching experience. Although there were no direct controls for learning ability, the educational level variable did function as a control for gross differences in ability level. In addition, there was very little dropout from the courses (CE 1%; TC 5% and DE 10-15%), so the selectivity effect was not a concern. Even in the case of Distance Education, dropout seemed more related to a variety of personal problems than to academic performance.

For the cost-effectiveness analysis, we compared cost per student per cycle with a single effectiveness index, which was formed by standard scoring and combining all effectiveness indicators except those for attitudes, which tended to move in a direction contrary to the others. The effectiveness measure that entered the cost-effectiveness ratio was the difference between entry level and exit level on the composite index.

Findings: Sri Lanka

Program Costs

The main results of our costs analysis are presented in Table 1. When the overall costs are considered, it is clear that the training at the Distance Education centers is considerably less expensive than that at the more conventional colleges, costing about 1/6 as much as that at the Colleges of Education (pre-service) and 1/3 as much as that at the Teachers' Colleges (conventional in-service).

When the source of funds is considered, it is clear that trainees in the Distance Education bear a much

Table 1: Total Costs Per Student Per Year by Type of Institution and Source of Funds (1988, In U. S. Dollars)

Source of Funds	College of Education	Teachers' College	Distance Education
Overall	1,401	878	251
To Sponsor	982	702	88
To Trainees	226	<285>	167

Note: Costs to sponsor and to trainees do not add to overall costs because of the net effect of transfer payments.

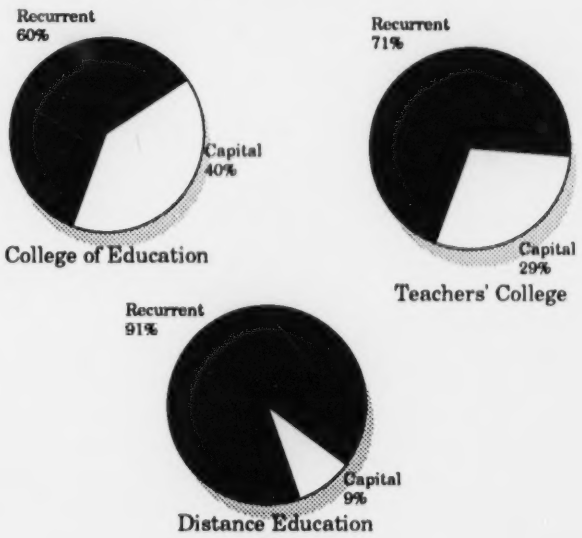
higher share of the total costs than trainees in the other programs do. While trainees in the Colleges of Education cover only 16% of their costs, those in the Distance Education programs assume a full 2/3 (67%). Trainees in the Teachers' Colleges bear no cost burden at all; in fact, they leave the program with a net gain because they receive their full salaries during training and sacrifice very little in terms of program fees and foregone income. As regards the relatively high cost burden for the Distance Education trainees, 2/3 could be considered very heavy, except that the program's total costs are so low that the $167 they pay or forego per year is actually lower than trainees' costs in the Colleges of Education.

About 70% of the private costs for those in the DE program are foregone income. This may come as a surprise to those who have asserted that distance education (because it involves part-time study by those still in the workforce) is free of opportunity costs. This may be true for courses taken as a hobby, but in this program of teacher certification the work load is heavy and prolonged; the average trainee covers a two year full-time course in just over three years, working part time. Obviously, such a load leaves little time for the kind of part-time work that is so common (some would say essential) for teachers in this part of the world. One compensation for bearing this kind of burden is the fact that DE course completers are allowed to continue teaching in their current locations, whereas those who are trained at residential colleges are often posted (or transferred in the case of in-service trainees) to difficult areas.

When only the cost to sponsor is considered, as it would be if the government wanted to know how much it needed to invest, the DE program appears extraordinarily economical: Government costs for DE are less than 1/10 of those for the Colleges of Education and almost 1/8 of those for the Teachers' Colleges. Currently a high proportion of the DE program institutional costs are being borne by a donor agency, Swedish SIDA. Once it withdraws, as it eventually must, the government could sustain the program out of its own funds fairly easily. In fact, it could carry eight trainees in the DE program for the same cost as one trainee at the Teachers' College.

The mix between capital and recurrent costs is illustrated in Figure 1. It is remarkable how different the programs are in terms of the amount devoted to capital costs. In the Colleges of Education, which are residential and elitist, 40% of costs are capital costs. These costs cover not only lecture halls and dormitories, but also administrative buildings and offices, electronic equipment (computers and audio-visual hardware), and recreational/sports facilities and equipment. This is in keeping with the goals of these institutions to provide an intensive learning and socialization experience for future leaders in primary education.

Figure 1: Capital and Recurrent Costs for Training Programs in Sri Lanka



In the Teachers' Colleges capital costs are only 29% of the total. Campuses in this program provide very basic lecture and living facilities, and very little else. They may have a typewriter or two, a TV and mimeograph machine, but very little other equipment.

Finally, capital costs in the Distance Education program are minimal (9%). Like most DE programs in which self-instruction is the norm, this program has modest space demands. All it uses are a few office buildings in Colombo, where it produces instructional materials, coordinates programs, and keeps records; and some rented buildings in the regions it uses on weekends and holidays for tutorials. Unlike most DE programs, it spends very little on the production of media (TV and radio programs). It has instead decided to place heavy emphasis on tutorials and group work. In fact, its relatively heavy recurrent costs are devoted almost entirely to the provision of modules and the payment of tutors. The substitution of tutors for hi-tech educational media has kept the capital costs down, but since tutors are variable costs and production facilities are fixed, unit costs are unlikely to fall with any expansion of the program.

Program Effectiveness

The study in Sri Lanka reveals consistently positive results for the Distance Education program on all effectiveness measures. (See mean scores in Table 2 and the graphic presentation in Figure 2 using standard or z-scores). On the subject matter tests, DE exit-level trainees had higher scores than entry-level trainees did in both mathematics and language. The difference was higher in the language scores. On the indicators of teaching skills, similar results were found: exit-level trainees outscored entry-level trainees in both math and language, but with wider margins in language. Finally, a large positive difference in attitudes between exit and entry levels was observed.

When these results are compared with results from the other two programs, the pattern is mixed. Compared with the Teachers' College programs, the DE programs appeared more effective (in terms of difference between exit and entry) in four of the five areas measured: math and language subject matter mastery, math skills, and professional attitudes. Only in language skills does it appear to be slightly less effective. Compared to the Colleges of Education programs, the DE programs appeared more effective in only two of the five areas considered, language knowledge and professional attitudes. In math knowledge and both math and language skills the Colleges of Education appear to be more effective. In fact, the Colleges of Education program is the most effective of the three in these areas, whereas the DE program is the most effective in the area of language knowledge and professional attitudes.

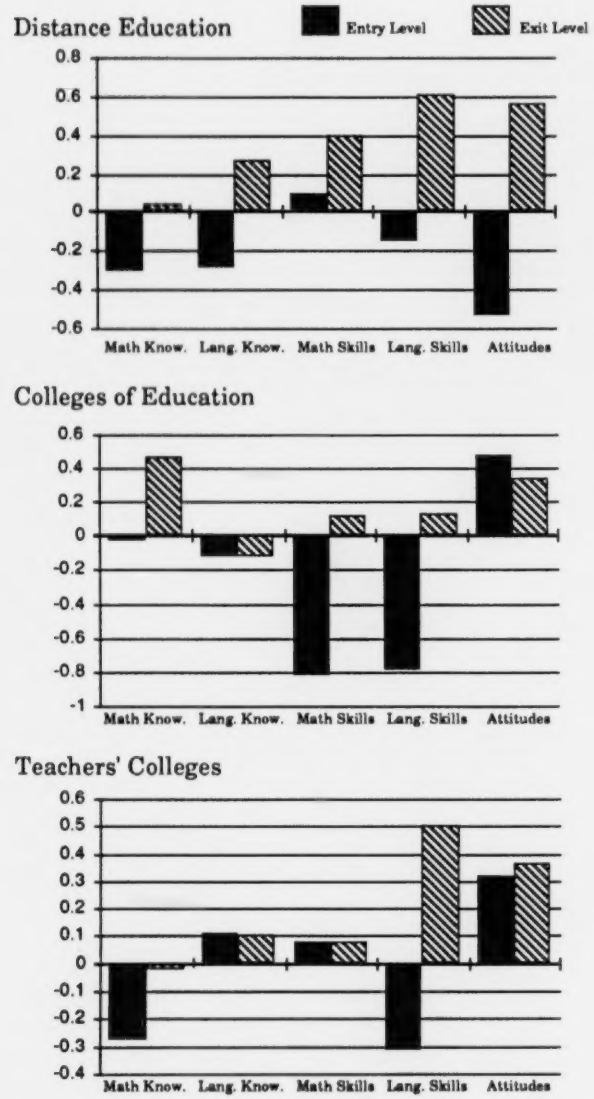
These differences in effectiveness among the three kinds of programs could be explained in terms of their various structural/organizational features. Clearly the Colleges of Education are the most elitist and also the most intense. Given the high ability and motivation of their students it is not surprising to find

Table 2: Mean Scores on Program Effectiveness Measures for Sri Lanka (Standard Deviations in Parentheses)

Program	Level	Math Know.	Lang. Know.	Math Skills	Lang. Skills	Attitudes
Distance Education	Entry	35.2	44.83**	50.73	56.40***	166.4***
		(14.1)	(11.62)	(13.00)	(13.00)	(10.29)
	Exit	40.75	54.31	56.45	70.20	185.1
		(15.75)	(16.59)	(18.73)	(14.60)	(11.48)
Colleges of Education	Entry	39.95***	47.72	33.82***	44.60***	183.7
		(12.85)	(13.72)	(13.73)	(14.13)	(12.20)
	Exit	48.25	47.69	51.45	61.47	181.3
		(15.25)	(17.48)	(14.54)	(11.80)	(13.31)
Teachers' Colleges	Entry	35.7	51.55	50.45	53.47***	180.8
		(15.9)	(15.55)	(17.00)	(14.33)	(16.98)
	Exit	40.25	51.45	50.45	68.27	181.8
		(19.6)	(16.79)	(18.82)	(17.80)	(16.83)

1. The probability value of the t-test of the difference between the entry- and exit-level means are indicated as follows: * < .05; ** < .01; *** < .001.
2. The knowledge and skills scales have been transformed into percent correct. The attitude scale is the sum of ratings over all attitude scale items. Its range is 61-305.

Figure 2: Standard Scores on Effectiveness Measures, Sri Lanka



Colleges producing substantial knowledge gains. Also, given the fact that they had never studied pedagogy before, and then were exposed to some of the most up-to-date methods used anywhere (including simulation and field visits to schools and communities), it is not hard to understand why they show such great differences between entry and exit in teaching skills. What is surprising, however, is their poor showing on professional attitudes, given the fact that the program considers socialization as one of its most important goals. It may be that these elite trainees come into the program already filled with idealism and able to discern the "correct" attitude responses. Their idealism may flag somewhat as they begin to understand the real world of a teacher and anticipate their internship year in difficult schools. Findings beyond the scope of this study show that their attitudes become significantly more negative during their initial teaching years.[5] In any case, the current findings seem to show that there is a limit to what direct teaching and socialization can do in shaping the professional attitudes of prospective young teachers.

In the case of Distance Education, it is apparent that the program's particular mode of integrating study with ongoing work in teaching has borne fruit. Increased knowledge may be explained by the constant interaction with and feedback from tutors, whereas the effectiveness in skills acquisition may be a reflection of the group work (practical sessions and the exchange of experience and know-how) and the feedback provided by tutors during school visits. The fact that the DE program was more effective in improving both knowledge and teaching skills in language as compared to math is not surprising given the fact that much DE learning is still self-instructional. Throughout the world self-instructional programs are more effective in teaching verbal skills than they are quantitative skills. The positive effect of the DE program on professional attitudes may be more a reflection of the professional support from peers and tutors and an increase in competence and job satisfaction, than it is the result of explicit teaching and learning of appropriate attitudes. This point is buttressed by the findings of a follow-up study that once the course was finished and the graduates were back on their own again, attitude levels were found to be basically on a par with those of the entry-level group.[6]

The relatively weak program effects of the Teachers' Colleges could be a reflection of: a) the fact that the program mainly aspires to reinforce what the teachers already know and do in their classrooms, b) a traditional curriculum which emphasizes educational foundations (23% of coursework) and "principles of primary education" (41%), and c) the elimination of the internship year. In contrast to the other two programs, both of which developed very close relationships between training and the real world of the classroom, school, and community (CE through field trips and community service and DE through on-

the-job training), the TC program was quite removed (both physically and in its substance) from the day-to-day concerns of students and teachers. Given that little changed in terms of their professional knowledge and skills, it is not surprising that their attitudes were also basically unaffected by their program.

Program Cost-Effectiveness

The value for money (Taylor, 1983) or efficiency (Windham, 1988) of the Distance Education programs, compared to that of the more conventional ones, is illustrated by the cost-effectiveness ratios found in Table 3. In this table we summarize the difference between the entry and exit groups on the composite index of effectiveness indicators[7] (column a) and the total cost per cycle[8] (column b) for each program.

Table 3: Cost-Effectiveness of the Various Teacher Education Programs, Sri Lanka

Program	Difference In Composite Index* (T2-T1) (a)	Total Cost Per Cycle (b)	Cost Per Unit Difference (b/a)
Colleges (Pre-Service)	2.36	$2697	$1145
Colleges (In-Service)	1.08	1690	1473
Distance Education	1.95	483	247

* The composite scores are the sum of Z-scores for the effectiveness measures.

The results for Sri Lanka show a high level of efficiency for the Distance Education program in comparison with the others. Although its level of effectiveness was not as high as the college pre-service program's (CE), its enormous cost advantage makes it much more efficient. The campus-based in-service program (TC) turns out to be least efficient, a consequence of a relatively low level of effectiveness and relatively high costs.

It should be noted that the above cost-effectiveness ratios included students costs. If the ratios were computed using only costs to sponsor, they would show even higher value for money for the DE alternatives.

Summary

The program costs and effectiveness of the three main approaches to primary school teacher training were assessed in Sri Lanka. The findings point clearly to the following conclusions:

1. The Distance Education program in Sri Lanka was considerably less expensive per trainee than the more conventional alternatives: total costs per trainee for DE were about 1/6 of those for the Colleges of Education and about 1/3 of those for the Teachers' Colleges. If trainee costs are not included then the DE program appears even more economical, with per trainee costs about 1/10 those of the CEs and 1/8 those of the TCs.

2. The DE program places a relatively heavy cost burden on its trainees (67% as opposed to 16% for the CE). However, since its overall costs are so low, these costs are still lower in absolute terms than those for the conventional colleges. For the Teachers' Colleges, trainee costs were negative, since allowances outweighed both fees and foregone income.

3. Policymakers may be surprised at the relatively high private costs of DE participants, since the fees for program participation are almost negligible, and transportation costs and incidental expenses are modest. In fact, the highest private costs by far are generally neither acknowledged nor measured, namely opportunity costs. In the DE program these accounted for 70% of the private costs. This is understandable since the course load in the DE program is so heavy that pursuing it leaves very little time for earning supplemental income. In compensation, DE graduates can remain where they are currently posted, a plus in a country which is experiencing communal turmoil.

4. The capital costs of the DE program are extremely low (9%), especially in comparison to those of the other two programs (40% and 29%). This is a reflection of the program's rejection of the use of mass media and its lean profile both at headquarters and in the field. The fact that most of its costs go into self-instructional materials and small-group tutors (both variable costs) means that there is little or no room for further economies if and when the program expands. Being already at a very low cost per head level, however, it does seem possible that the program could be sustained indefinitely through routine budget allocations, even after the discontinuation of donor agency support.

(In Indonesia) DE trainees pay more than the conventional program trainees... ($613 compared to $461).

5. An analysis of program effectiveness has shown positive results for the DE program on all indicators. Exit-level trainees attained higher scores in tests of knowledge, skills, and attitudes than entry-level trainees did, with the best showings in language teaching skills and attitudes. It seems that DE's combination of self-instruction and group work is more suited to acquiring knowledge and skills in language than in math.

The findings for Distance Education were clearly more positive than those for the other in-service training program provided by the traditional Teachers' Colleges. Exit-entry group differences for DE were larger than for TCs in all but the language skills dimension. On the other hand, DE entry-exit differences were not as positive as those for the Colleges of Education, except in language knowledge and attitudes. The elitist and intensive CE program seems to have been able to recruit bright young students who have quickly mastered the subject content and skills. Their enthusiasm for the profession seems to have tapered off over the course of the program, however, perhaps after they had a taste of actual teaching experience (an impression confirmed by further erosion of attitudes during their first year of teaching). Clearly, the program's explicit attempts to shape teacher attitudes did not bear the kind of fruit expected.

The DE program, on the other hand, was quite successful in raising teacher attitudes from low levels to high. Since there were no explicit attempts to influence attitudes (of the kind made in the CE courses), this change was explained as more of a by-product of teacher satisfaction with improved professional support from peers and tutors, and with growth in their own professional competence.

6. Given the DE program's relatively low costs and relatively high effectiveness, its high cost-effectiveness is not surprising. Its cost per unit of change in the effectiveness index was a fraction (1/5 to 1/6) of the cost for the other two programs.

The Cost-Effectiveness Study in Indonesia

Sampling

In Indonesia we sought a wide variety of geographical areas which had both the conventional and the distance D-II programs. At first we selected three cities, two on Java (Bandung, West Java and Surakarta, Central Java), and one on Sumatera (Palembang, South Sumatera) as a reasonable cross-section of locations. We sought to select a sample of 100 math and 100 language trainees at both entry and exit level from both kinds of institution, as follows:

Sampling Frame: Indonesia

	Level	
Program	Entry	Exit
Conventional Colleges		
Math	100	100
Language	100	100
Distance Education		
Math	100	100
Language	100	100

The contribution of each institution to this quota was to be proportional to its size. The quotas were considered reasonable on the basis of past enrollment histories. As it turned out, there were many fewer students enrolling in the distance education program during our target year 1988/89 than expected, which forced us to expand our geographical range to include another three cities, Semarang, Surabaya, and Malang. Even so, we were only able to find a fraction of the number of students that we sought at entry level in the distance education program. Our achieved sample was as follows:

Achieved Sample: Indonesia

	Level	
Program	Entry	Exit
Conventional Colleges		
Math	126	121
Language	99	91
Distance Education		
Math	43	95
Language	42	87

The failure to meet the quota of entry-level trainees in the distance education program is a reflection of the decline in enrollments during the target years, an issue we will discuss in the outcome section on costs. This sample size difference prompted us to carefully check the background characteristics of our entry- and exit-level groups.[9] We wanted to be sure that they were sufficiently well matched to permit us to use the cross-sectional design. In fact, we found that the exit-level group was significantly higher than the entry-level group in age, teaching experi-

A large proportion of the (DE) trainees have to sacrifice their earnings from second and third jobs in order to pursue the course.

ence, and academic ability[10] (but not different in sex or distance from the study center). The difference in age and teaching experience is understandable, since the exit-level group had entered the in-service program over two years prior to the entry-level group and had continued teaching all that time. The most likely explanation for the higher academic ability scores of the exit-level group is the fact that our sample was of relatively early program completers (they took an average of 2.5 years to complete as opposed to the overall average of about 3.5 years). Faster than average course completion may be an indication of higher than average learning ability. To take into consideration the possible confounding effects of these experience and ability factors on our outcome measures, we entered the factors in our analyses as covariates. Thus, the means scores on the outcome measures for the distance education program are "adjusted" for teaching experience and academic ability.

We compared the background and experience of those at entry and exit in the campus-based programs and found the two groups to be basically homogeneous. Thus, there was no need to use covariates in the case of the conventional programs.

Data Collection

Cost data were collected through interviews (institutional data) and questionnaires (student data) just as in Sri Lanka. Data collection for the subject matter test was also done essentially as it was in Sri Lanka, except that each trainee only took one test. Concerning teaching skills, all trainees took a paper and pencil test of understanding appropriate teaching behaviors, which we refer to as "skills (theory)." Items on this test were based on the Ministry of Education's list of 10 basic teaching competencies, including such dimensions as classroom management, use of media resources, managing student-teacher interactions, and evaluating student achievement. In addition, a 20% sample of respondents, drawn at random from each institution, was asked to prepare and present a 20-minute micro-teaching lesson on a standard topic in either math or language before a class of teenagers. This appears in our tables as "skills (practice)." Observers, trained to high levels of inter-rater reliability through the use of video tapes, rated the lessons using seven point scales on dimensions such as preparation, organization, use of audio-visuals, relevance to the pupils' lives, involvement of class members, use of feedback, learning evaluation, and teacher enthusiasm. Two observers rated each teacher.

Attitudinal measurement was accomplished as in Sri Lanka through the use of a locally-developed attitude scale. Items to measure the attitudinal dimensions mentioned above were created by one of Indonesia's experts on teacher attitudes assessment. For purposes of validation, they were administered to two groups of 25 teachers, one characterized by their principals as having positive attitudes towards teaching, and the other as having negative attitudes. Those items which discriminated between the two groups in the expected direction were used in our final analysis.

Data Analysis

The data were analyzed basically in the same way as in Sri Lanka: Total costs were broken down by source of funds (sponsor or students), and into categories of capital and recurrent. Effective measures were presented separately for the two subject areas, mathematics and language. They were presented as means scores (or adjusted means scores in the case of the distance education program) for subject matter mastery, teaching skills (theory), teaching skills (practice), and professional attitudes. For the cost-effectiveness analysis an effectiveness index was formed including all but the attitudinal items using standard or Z-scores.

Findings: Indonesia

Program Costs

Our unit cost analysis, which is summarized in Table 4 below, shows that the distance education program in Indonesia is less expensive than the conventional college program, the overall costs of the former being about 60% of the costs of the latter ($952 vs. $1578). As in Sri Lanka, DE trainees bear a considerably higher proportion of the costs than trainees do in the conventional colleges: 64% as opposed to 29%. This high level of "cost recovery" from clients has allowed the Open University to keep its institutional costs down, to the point that they have only about 1/3 the institutional costs of the conventional colleges.

Table 4: Total Costs Per Student Per Year by Type of Institution and Source of Funds (1988, in U.S. Dollars)

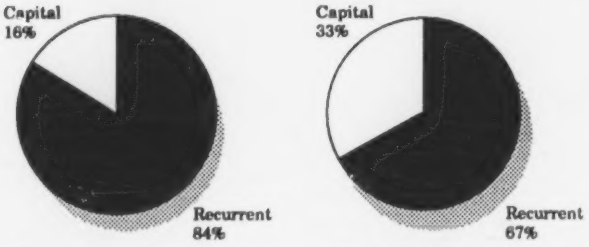
Source of Funds	Conventional Colleges	Distance Education
Overall	1578	952
Sponsor	1117	339
Trainees	461	613

Returning to the costs to trainees, it can be seen that the DE trainees pay more than the conventional program trainees, not only in relative terms, but also in absolute terms ($613 compared to $461). The amount for the distance education program has been converted into a "full-time equivalent" figure. Since the trainees take about 3 1/2 years on average to finish the 40 unit program, the actual amount that they pay or forego per year is actually around $175. During 1987-88 a lower secondary school teacher was earning on average about $122 per month or about $1400 per year. This means that the actual cost of the program to the trainees came to about 12% of annual earnings. In a previous study of D-II program costs (Nielsen and Djalil, 1989), it was demonstrated that student dropout began to become a problem when the course costs reached 16% of annual income. The private cost burden in this study already approaches that proportion on the average, and is certainly at or above that figure for a number of participants. This will clearly have an effect on perseverance in the DE program as well as initial demand for it, unless new incentive systems introduced in 1990-91 make the courses look attractive again.[11]

A breakdown of trainees' expenses shows that around 60% are opportunity costs. This finding replicates a similar one in Sri Lanka, and once again contradicts the frequently made assertion that distance education programs carry no opportunity costs. A large proportion of the trainees have to sacrifice their earnings from second and third jobs in order to pursue the course. In the early years of the program this sacrifice was compensated for by the scholarships to cover course fees and materials. Recent government moves towards more financial austerity (forced in part by falling oil prices) have all but eliminated government scholarships, removing an important financial incentive. This is clearly one explanation for the drastic fall in new enrollments in the past two years. Prospective trainees are finding that the benefits of an Open University D-II program are not worth the costs to them, especially when they can use their spare time working at jobs like teaching in private schools or tutoring.[12] If such trends continue, they could seriously affect enrollments and the capacity of the program to benefit from economies of scale.

The mix between capital and recurrent costs in Indonesia is the opposite of that found in Sri Lanka. The DE option here devotes about twice as much to capital expenditures as the conventional programs

Figure 3: Capital and Recurrent Costs for Training Programs in Indonesia



Conventional Colleges Distance Education

do (33% compared to 16%). The conventional D-II programs are offered on large university or institute campuses where they typically share facilities (libraries, lecture halls) with other programs. Their main costs are thus recurrent, largely to cover staff salaries. In contrast, the Open University program spends relatively little on its teaching staff, since tutorials are a minor feature in its course, but has invested heavily in new campus facilities, course development, and the production of audio-visual materials (radio and TV programs, and audio cassettes). The relatively high capital costs make Indonesia's DE program more expensive than Sri Lanka's, but since these can be spread ever thinner as the student body increases, the program is in a better position to reap the benefits of economies of scale. This is all the more reason to be concerned about the decline in enrollments.

Program Effectiveness

The relative effectiveness of the distance education program in Indonesia is illustrated in Table 5 and Figure 4. Once again, it should be emphasized that the results for the distance education program are for a one year full-time equivalent course, whereas those for the conventional colleges are for a two year program.

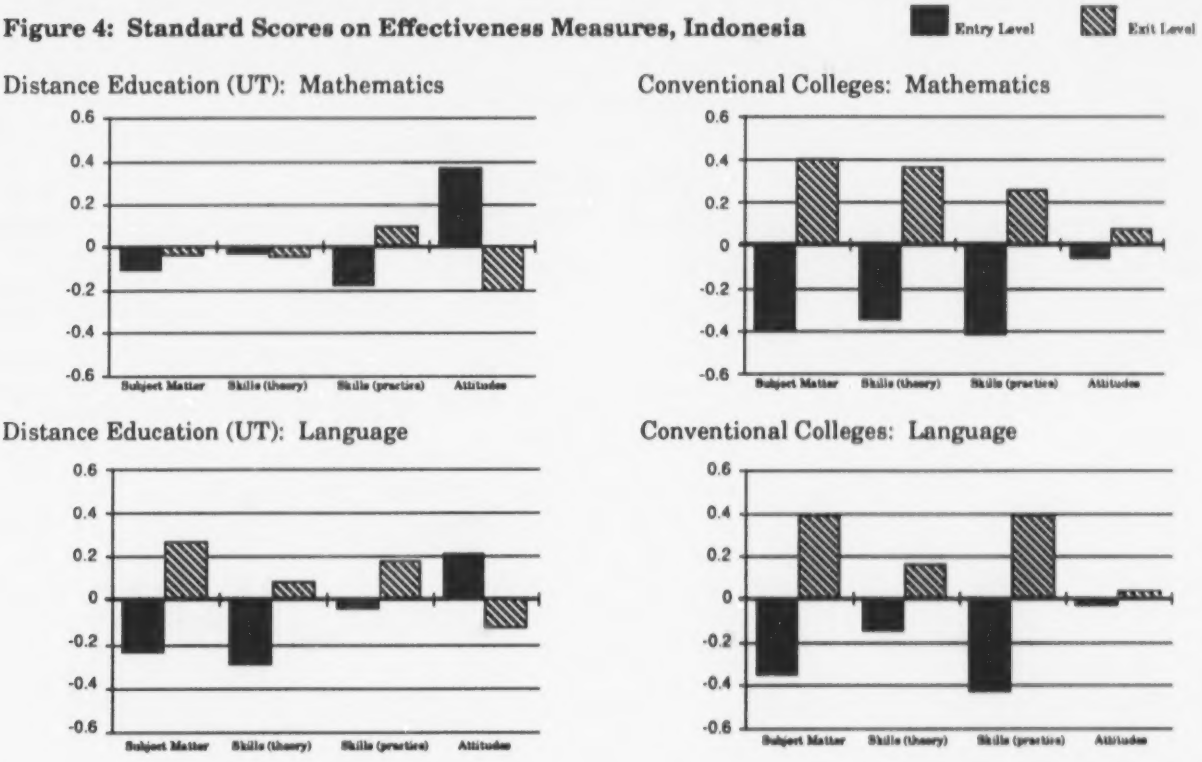
Looking at the results for the distance education program (Figure 4), it is clear that the one year program has made a considerable difference in the language program participant's subject matter mastery and teaching skills, but relatively little difference in practical skills. In contrast, the one year program in mathematics has had virtually no impact on subject matter mastery and teaching skills, but a small impact on practical skills. In both courses, the

Table 5: Mean Scores on Program Effectiveness Measures for Indonesia (Standard Deviations in Parentheses)

Program	Level	Subject Matter	Skills (Theory)	Skills (Pract)	Prof Attitudes
Distance Education					
Mathematics	Entry	43.1	65.7	75.2	68.9**
		(13.1)	(10.6)	(9.0)	(7.9)
	Exit	44.0	65.5	78.5	62.8
		(11.2)	(9.5)	(9.8)	(8.7)
Language	Entry	51.6*	61.0	77.1	69.0
		(11.1)	(9.7)	(11.6)	(9.0)
	Exit	56.9	65.0	80.0	64.4
		(7.5)	(10.2)	(8.2)	(9.2)
Conventional Colleges					
Mathematics	Entry	40.0***	61.4***	58.3*	64.4
		(9.38)	(8.3)	(10.7)	(7.6)
	Exit	48.9	67.9	67.4	65.4
		(11.0)	(6.9)	(10.3)	(7.0)
Language	Entry	57.8***	66.9*	69.4**	67.0
		(7.7)	(11.0)	(8.9)	(7.8)
	Exit	63.7	70.0	78.4	67.3
		(7.0)	(8.4)	(8.0)	(8.2)

1. The probability value of the t-test of the difference between the entry- and exit-level means are indicated as follows: * < .05; ** < .01; *** < .001.
2. For the Distance Education program all mean scores were adjusted for trainee academic ability and teaching experience using ANOVA.

Figure 4: Standard Scores on Effectiveness Measures, Indonesia



impact on practical skills seems to be constrained by the fact that learners entered their respective programs with relatively high marks in practical skills. (See Table 5.) Such levels can be seen as creating a ceiling effect. Even if the program had emphasized practical skills training (which it didn't) trainees probably wouldn't have shown much change, because of regression towards the mean.

In the realm of attitude acquisition the results were strikingly similar for the two courses: in both, professional attitudes at exit are lower than at entry.

In the conventional, two year, campus-based program, both courses show significant differences between exit and entry on the subject matter and skills indicators. In the mathematics course the differences were robust on all measures except attitudes. In the language course, the differences were strong in subject matter mastery and teaching practice, but relatively modest on the theoretical knowledge about teaching. On the attitude measures there was virtually no difference between exit and entry in both courses.

Comparisons between the two kinds of courses need to be done carefully, because of the differences in length. If one converted the differences between entry and exit for conventional colleges' differences per year, they would still be **much higher** than those of the distance education program in mathematics. In language, the differences per year for the conventional colleges would be about the **same** as those for the distance education program in subject matter mastery, but **lower** in skills (theory) and **higher** in skills (practice). Thus, on balance the conventional college language course appears to be no more effective than the distance education course.

If one compares the two kinds of programs on attitudinal change, it is apparent that the distance education program participants moved in a negative direction, whereas those in the conventional colleges didn't move at all. Both programs have specified professional attitude change as an important goal, but neither has implemented any explicit program to accomplish this. The apparent negative effects on the distance education program are seen as side-effects of the following: a) frustration or disillusionment among the trainees as a result of having to work in isolation; b) the discrepancy trainees might feel between their new credential and their professional status/salary level, which would not have changed yet, and which may not change as fast as they feel it should for recent graduates of a higher education program. A further explanation has to do with the reliability and validity of our attitude measures. There were so few items in our final validated scale (12), that its stability could be a problem. In addition, no matter how hard we tried to validate the items in our scales, we found measurement in this realm to be elusive, given the Indonesian pre-occupation with giving socially desirable answers. It would be desirable to review this issue in future studies using more qualitative research methods.

Program Cost-Effectiveness

The cost-effectiveness assessment in Indonesia (Table 6) is one way to compensate for the different lengths of the two kinds of programs. In it, the effectiveness measures for the program are combined (using standard scores) and then compared with the costs for the entire cycle (either one or two years).

Table 6: Cost-Effectiveness of the Various Teacher Education Programs, Indonesia

Program	Difference in Composite Index* (T2-T1) (a)	Total Cost Per Cycle (b)	Cost Per Unit Difference (b/a)
Distance Education			
Math	0.33	$ 946	$2867
Language	1.10	958	871
Conventional Col.			
Math	2.21	2997	1356
Language	1.88	3314	1723

* The composite scores are the sum of Z-scores for the effectiveness measures.

Thus, for the distance education course, the effectiveness measures are compared to the costs for one full-time equivalent year, and those for the conventional programs with two years. The cost-effective ratio can be taken as an indicator of program efficiency. As shown in Table 6, the distance education program appears more efficient than the conventional program in language, but considerably less so in mathematics. The former outcome is almost entirely explained by the lower costs of the distance education program, since the effectiveness indicators are almost the same for the two kinds of programs. The outcome for mathematics is mainly a reflection of the

low level of effectiveness in the DE program, the difference between entry and exit level being almost nonexistant. Thus, even though the DE math course is considerably cheaper than the pre-service equivalent, its low level of effectiveness makes it relatively inefficient. In overall terms, the most cost-effective program appears to be the distance education program in language, and the least, the distance education program in mathematics. Of the two programs in the middle, the conventional program in math is more cost-effective than the conventional program in language, not only because it is more effective but also because it is cheaper.

Summary

Assessment of the costs and effectiveness of the two major approaches to lower secondary school teacher training in Indonesia presented formidable methodological challenges, but in the end some clear patterns were discernible, namely:

1. The distance education program was less expensive than the conventional college programs in terms of total costs per student per year (or equivalent). In overall costs, the DE program was about 60% as expensive as the conventional college course, but when private costs were removed, the DE costs per student were found to be about only 30% as expensive as those for the conventional colleges.

2. Students in the distance education program bear a relatively high cost burden: about 64% of total costs as opposed to 29% for the campus-based students. The actual amounts spent or foregone by DE students is higher than that incurred by conventional program students when full-time equivalent costs are compared. In practice, DE students spread those costs over 3 1/2 years, on the average, but even this results in expenditures which are about 12% of annual earnings for the average lower secondary school teacher.

3. A large proportion (about 60%) of the costs to trainees are opportunity costs, a finding which contradicts the frequent assertion that distance education programs allow learners to maintain their regular earning patterns. This situation, combined with the fact that scholarships for the D-II program have been virtually eliminated, has depressed the demand for the D-II course, and threatens in the long term to reduce the level of course enrollment below that required to generate economies of scale.

4. Capital costs are a much higher proportion of total costs in the distance education program than in the conventional college programs. This reflects the trade-off between the use of courseware production and mass media in the former (high on capital costs) and the use of large forces of lecturers and administrators in the latter (high on recurrent costs). This kind of mix will allow the distance education program to reduce its per capita costs with the increase in the number of trainees, since the same fixed costs can be spread over greater numbers of participants.

5. The distance education program in language appears to be relatively effective, even after the equivalent of only one full-time year (40 units), particularly in mastery of content matter and knowledge about teaching skills. Its effectiveness was not demonstrated in the area of practical skills improvement. In the field of mathematics, the 40 unit DE program was not effective in any of the effectiveness domains, but its effect appeared particularly weak in subject matter mastery. As in Sri Lanka, it appears that DE education in Indonesia is more effective in conveying knowledge and concepts than it is in conveying practical and computational skills.

6. Cost-effectiveness analysis showed that the most efficient of the programs was the language program provided through distance education. Its effectiveness after one full-time equivalent year was almost as high as that of the two year campus-based program and its cycle costs were only 1/3 those of the comparison program. The same analysis showed the DE mathematics program to be relatively inefficient. Although its economies were about the same as those of the language programs, its extremely low effectiveness scores caused it to show very high costs per unit of effectiveness, higher than for either of the two conventional college programs.

Section IV: Cross-National Comparisons

The two studies reported on here, conducted under the BRIDGES Project in Indonesia and Sri Lanka, are attempts to provide empirical evidence concerning the cost-effectiveness of distance education programs for teacher training. This was undertaken in order to assist policymakers in identifying effective, yet affordable, ways of upgrading teachers, even during these times of constrained or shrinking educational budgets. The cost-effectiveness of distance education programs was compared to more conventional programs so that there might be a basis for determining "value for money" and a sense of the "comparative advantages" of the two kinds of approaches. Beyond that, the findings in the two countries were compared in order to see if there were any discernible patterns across countries and to explore the possible effects of distance education design factors.

...the Sri Lankan style tutorial and group activities were what made the difference in the effectiveness of the DE programs in the two countries...

In general it can be maintained that distance education programs for teacher training in Sri Lanka and Indonesia do provide value for money, particularly when only government expenditures are considered. This was especially true in Sri Lanka where the economies were especially strong and program effectiveness was in evidence for all indicators. In Indonesia, the economies were also apparent, albeit weaker, but effectiveness was demonstrated only in the language program.

The main feature which distinguished between the DE programs in the two countries was the degree of student support through learning groups and tutors. In Sri Lanka there were various forms of learning group activities (study circles, practical sessions, and contact sessions during school vacations) as well as counselling, feedback, and school visits by tutors. In Indonesia there were at most two optional tutorials per semester, both large group affairs where trainees assembled in lecture halls to have their questions answered. Our basic premise is that the Sri Lankan style tutorial and group activities were what made the difference in the effectiveness of the DE programs in the two countries, essentially because they included small group problem-solving sessions and linked what was being learned in the course with what the teacher trainees were doing in the classroom. This school-focused form of distance education appears to have influenced attitude changes as well: trainees involved in it appear to have developed more positive attitudes towards teaching, while trainees in Indonesia—left essentially on their own—experienced attitude shifts in the negative direction.

As an alternative (and in fact more conventional) distance educational model, the Indonesian program provided more in the way of mass media support—radio, TV, and audio cassettes. However, these do not appear to be widely used. The courses are still primarily print-oriented and self-instructional. The findings of this study lead to the assertion that the small group tutorial is a much more effective means of supporting teacher training than is the use of mass media. This is consistent with the position of others (Dodds, 1988) who have demonstrated that distance education in Third World countries should not be too distant, but instead entail a combination of distance teaching and small group interaction.

The fact that, in both countries, mathematics knowledge and teaching skills are more effectively learned in conventional pre-service courses than through DE is a finding to be dealt with by the distance educators. In Indonesia, once background characteristics are controlled, there appears to be very little change in math knowledge or teaching

skills (theory). In Sri Lanka, there is some positive movement during the course but not as much as in the Colleges of Education. We conclude from this that distance education, which is largely (even in Sri Lanka) built upon self-instruction, is not as effective in conveying skills as it is in providing knowledge and information. For this reason we could speculate that it would not be particularly effective for training in science (which is precisely what Mahlck and Temu, 1989, found in Tanzania), but relatively strong in the social sciences (yet to be tested). It may also be weak in teaching languages other than the mother tongue, since this also involves the acquisition of new skills. The point is that math, certain kinds of science, and foreign languages all require the mastery of skills, whereas the other subjects require the understanding and recall of facts and information. Skill acquisition is more difficult through self-instruction, since it requires exercises and practice and, preferably, live feedback. The Sri Lankan DE program, through its group work and tutorials, provides some of this, and is therefore moderately effective with math and teaching skills. Even so, it still does not measure up to the campus-based College of Education program.

Overall, it is clear that for effective teacher upgrading, distance education programs should not be too distant. They require support and group learning systems that are linked with schools and focused on day-to-day school problems. To be most effective they also need to provide some practical sessions and tutorial visits. This sounds expensive, but the experience in Sri Lanka shows us that it need not be so, especially if the program uses existing premises and does not invest heavily in mass media. Such distance education systems may be considered school-oriented or school-focused (Bolam, 1982) as opposed to media-focused.

Section V: Implications for Policy

From the beginning this research was designed to address policy issues, both at the national and at the international level. At the national level, the hope was to provide input into fairly specific program design and management issues; at the international level it was to reveal some general patterns that might suggest new or better ways of improving the quality of basic education. In presenting the policy implications of this research, we will consider those at the general or international level first; then we will proceed to the more specific national arenas. Given the fact that many countries face similar problems, it is likely that even national-level policy recommendations will find applications beyond the relevant country's borders.

Distance teacher education programs...are cost-effective... particularly in subjects that require the mastery of knowledge and information.

General Implications

Using the standard of cost-effectiveness, our findings seem to justify the use of distance education for the in-service training of teachers. The case is especially strong in the case of subjects that are based on verbal skills or the acquisition of knowledge and information. The case is less strong for the acquisition of math skills and the development of attitudes, yet the experience in Sri Lanka shows that under the right circumstances even these can be done cost-effectively. The use of local learning groups, especially to practice teaching skills and reflect on how the new learning relates to the teacher's own classroom situation, appears to be one (if not the) key ingredient of an effective distance education program. Such groups, and occasional school visits by tutors, tend to make the learning program "school-focused" and relevant to the teacher's needs, features which seem to account for high teacher morale and positive attitudes towards teaching. Furthermore, it cannot be assumed that just because a teacher is experienced, she/he cannot learn more in the way of teaching skills: school-focused distance education has the capacity to lift teachers to higher levels of teaching competence.

Concerning costs alone, distance education can cut the cost of teacher education from 1/6 to 2/5 of what is spent on equivalent conventional programs, as long as the program maintains an enrollment high enough to capture economies of scale (in the thousands). DE programs also provide the opportunity for cost recovery from students that conventional programs, for reasons that are often political, cannot. Such cost recovery still does not place an undue burden on the trainees, since the overall costs of the programs are so modest. When judging the level of the cost burden, however, policymakers need to be sensitive to the likelihood of the students' incurring opportunity costs: in many cases this part-time instruction will compete with a teacher's secondary sources of income.

Implications for Sri Lanka

The findings in the case of Sri Lanka seem to show that the traditional, residential, in-service Teachers' College programs have been surpassed in cost-effectiveness by the more recent alternatives (pre-service and distance) and may not be worth maintaining any longer. They also show that the pre-service programs' (CE) high costs have pulled their "value per money" down to a level well below that for distance education. The pre-service programs do appear to be serving the extremely important function of drawing talented youth into the teaching force, who can be placed (at least initially) in difficult areas. However, these programs are expensive to set up and maintain, and their output is currently far below that needed to fill the current demand for new teachers. Given the high capital costs of the Colleges, mounting them in sufficient numbers may be out of reach.

Thus, the government may need to consider ways of substantially reducing the costs of these Colleges, perhaps by using physical facilities of other programs, such as any Teachers' Colleges that may be closed in the future.

Concerning the Distance Education program, it appears to have an important role to play in upgrading the current backlog of untrained teachers. Given the low costs of the program, it could be expanded quickly at relatively little expense, allowing it to clear the backlog even faster than it does now. Once it does so, however, it will reach the paradoxical point of having eliminated its reason for being. At this point, all teacher education would presumably be through the pre-service mode.

But this situation will also present a paradox, since the success of the program to date has been based largely on its selectivity or elitist image. Once all teachers are trained in this mode, this image will disappear. At this point, the elitist route will more than likely be through the university. Already a few "graduate" teachers are being produced. If international trends are any guide, Sri Lanka will eventually move towards the standard of requiring new teachers to have university degrees. But this route is even more expensive than Colleges of Education.

One way to overcome this dilemma is to draw Distance Education into the process of pre-service teacher education. Providing some of the pre-service training via on-the-job training, using Sri Lanka's system of school-focused, group-oriented distance education, may allow for substantial savings. Such hybrid programs have already been used in other countries such as Zimbabwe (Gatawa, 1986, on the ZINTEC program) and Papua New Guinea (Crossley, 1989; Guy, 1989), using alternating periods of residential and distance training. Drawing DE into pre-service training in this manner would also mean that the skills and infrastructure developed for this successful innovation would not be wasted but used to their fullest.

Implications for Indonesia

Indonesia's distance education program has the potential to provide cost-effective training in a wide variety of fields, but now it appears that trainees are too isolated. The organization of learning groups, close to the trainees' schools and with activities focused on school problems and conditions, would appear to be a means for improving program effectiveness. Such a move would also be a way to reduce the relatively high student cost-burden of the current Open University program. For example, with groups closer to home, trainees would pay less for transportation to tutorials and exams and would be able to pool modules with nearby fellow students (perhaps through the establishment of some sort of learning materials library).

Efforts to lower the private costs of distance education in Indonesia should be taken seriously. At this point, when opportunity costs are included, such costs are higher for distance education than they are for conventional training. This seems to be one reason for the recent drop in enrollment: the benefits derived from the training simply haven't seemed to justify the costs and effort. (Nielsen and Djalil [1989] have shown that DE trainees begin to lose their incentive to pursue the course once its costs are beyond 16% of their monthly earnings, a level found in the case of many trainees.) Relief could come through opening local study centers as mentioned above, re-instituting scholarship support, especially to those in difficult circumstances (living in remote areas, having many dependents, having no chance for supplementary income, etc.), and instituting a counselling program for trainees to help them manage their time to reduce foregone income. In Indonesia, increasing participation in the program can have a multiplier effect, since the greater the enrollment the lower the unit costs. The reduction in unit costs could presumably be passed on to the students in the form of reduced fees, a further incentive for increased enrollment. From another point of view, obtaining D-II teaching certificates will need to be made more rewarding both professionally and financially.

During the course of this research many of the recommendations mentioned above have become increasingly feasible. For example, during 1989 a decision was made to offer the D-II program to primary school teachers, in this case with a very intensive (i.e., weekly) group tutoring component at the school cluster level. A logical next step would be to put such a component in the program for lower secondary school teachers also. In addition, new professional support mechanisms are being set up at the subdistrict level for secondary school teachers called "subject matter discussion groups." These might be used as a vehicle for the D-II group learning activities, and, given the problem-solving orientation of these groups, they would be able to make the D-II program more school-focused. Finally, in early 1990 Indonesia initiated a Civil Service reform which will

provide good promotion possibilities for teachers who upgrade their credentials from D-I to D-II. Policymakers will need to watch carefully to see whether this provides additional motivation for enrollment in the D-II course among lower secondary school teachers.

Conclusion

The findings of this study seem to indicate that there is a relatively inexpensive way for governments to increase the effectiveness of their teaching force. Distance teacher education programs, at least those in Sri Lanka and Indonesia, are cost-effective, especially those that combine self-instruction with tutor-supported small group learning; and particularly in subjects that require the mastery of knowledge and information. Math and teaching skills can also be mastered through distance education, but only when tutorial support and group learning processes are strong. The low institutional costs of DE programs are, at least in part, a function of economies of scale and a relatively large cost burden being shifted to the trainees. This suggests the need to keep enrollments up and cost recovery from trainees relatively high—but not so high as to depress student demand. Institutional innovation, based on research and experimentation, will need to continue, so that distance education can reach its full potential in improving the quality of teaching.

Notes

1. Concerning opportunity costs, many writers assume that these apply only in the case of conventional programs: that because DE programs allow students to maintain their regular jobs, they require nothing in the way of student foregone income. This will be shown to be an invalid assumption.

2. Now referred to in English as the Indonesian Open Learning University.

3. Those counting the costs of distance education programs often use the "technical approach" (Eicher, et al.), which divides costs into four categories: general administration, production, distribution or transmission, and reception. These categories are particularly relevant to various aspects of mass media use, and since such use was minimal in the courses studied in Indonesia and Sri Lanka, this approach was found to be less appropriate than the more traditional approach advocated by Tilak (1985).

4. The total number of institutions in the three categories were as follows: Colleges of Education, 7; Teachers' Colleges, 16; Distance Education (regional centers), 30. The original intent was to sample from all regions of the country, but the law and order conditions at the time of data collection did not permit safe access to the North and South. The names of the institutions chosen were as follows: Hapitigama College of Education, Mahaweli College of Education, Bolawalana Teachers' College, Gampola Teachers' College, Kandy Distance Education Regional Center, Kegalle Distance Education Regional Center.

5. A study conducted among College of Education graduates in their first year of teaching shows them to have scores on the attitude test that are about 20 points (12%) lower than those of a comparable group at graduation. (Tatto, Nielsen, and Cummings, 1991).

6. The average group attitude scores for those in DE programs were as follows: Entry level, 166.4; exit level, 185.1; the year after graduation, 160.38 (Tatto, Nielsen, and Cummings, 1991).

7. We excluded the attitude measures, as mentioned above, since results on them were inconsistent with the results on the other measures.

8. The cycle is the length of time for program completion. Since the distance education program does not involve full-time study, the costs for the equivalent of a full-time program were used. In Sri Lanka, where the DE program covers the equivalent of two years of full-time study, this meant determining the full-time equivalent annual costs for a base year and then adding a second year with appropriate adjustments for inflation.

9. For this we used a conventional test of differences between means scores of background variables (t-tests) as well as a test of the homogeneity of variance in those variables, called the Bartlett-Box F test, which tests the hypothesis that the two groups are from different populations (based on the size of the variance for the variable for each sample) see the SPSS/PC+ V2.0 Base Manual (Chicago, Ill.: SPSS Inc., 1988).

10. The indicator for "academic ability" was first semester exam scores on courses which were given to all trainees. The exams have not changed in substance during the past three years.

11. The new program is called the "Functional Credit System" and is set up to provide a means for accelerating promotions. In it the upgrading of academic credentials is an important accelerator. However, it is too early to tell whether this system has created a reversal of recent D-II enrollment declines.

12. Ironically, those in rural areas are finding the Open University's D-II course more attractive than those in the city, even though course costs, such as transportation to study centers, are on the average much higher for them. The best explanation appears to be that they have fewer opportunities for finding outside jobs, such as teaching at private schools, and thus have lower opportunity costs. Previous studies (Nielsen and Djalil, 1989) also show that they attach higher status to an Open University degree than people from the cities do.

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